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The Hazardous Effects of Mobile Phone Towers on Animals and Human beings: A Bangladesh Perspective

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Abstract *— A concise summary of the research – introducing mobile phone towers, the expansion in Bangladesh, apprehensions regarding electromagnetic radiation (EMR), and the objective to evaluate its effects on both humans and animals. This document thoroughly analyzes existing scientific data concerning radio-frequency (RF) and electromagnetic field (EMF) emissions from mobile phone base stations (cell towers), along with their recorded impacts on wildlife (including birds, insects, small mammals, and plants) as well as humans. We examine epidemiological, experimental, and ecological research, pinpoint potential biological mechanisms (such as oxidative stress, behavioral alterations, and endocrine disruption), evaluate regulatory deficiencies, and offer suggestions for future studies and public health policies.*

Keywords *— **Electromagnetic, Radiation, Effects on both humans and animals, public health.***

I. INTRODUCTION

Bangladesh has experienced a significant surge in mobile telecommunication infrastructure over the past few decades. As of mid-2015, the number of mobile subscribers exceeded 130 million, a substantial increase from just 26.6 million a decade prior. Concurrently, more than 21,600 mobile towers have been established across both urban and rural areas. A considerable number of these towers are situated on the rooftops of residential buildings, in proximity to schools, hospitals, and densely populated areas, frequently without adequate setbacks or ecological considerations. In this context, the issues surrounding the ongoing non-ionizing radio-frequency (RF) emissions from base stations become increasingly pressing. Although international research has investigated RF/EMF exposure and its biological impacts, there is a pressing need for localized studies in Bangladesh, particularly concerning ecological and human health aspects. Radiation from Base Transceiver Stations (BTS) occupies the range of 800 MHz to 3000 MHz and it is a part of microwave frequency (MW) radiation (300MHz-300 GHz). Microwaves lie between radio frequency (RF) and infrared waves in electromagnetic spectrum.

Fig: Effects of microwaves on life

This paper aims to investigate:

1. The extent and characteristics of mobile tower radiation in Bangladesh.

2. The evidence regarding its effects on animals, plants, and humans.

3. The existing regulatory frameworks, their deficiencies, and methods of exposure assessment. 4. Suggestions for policy development, research initiatives, and practical applications.

II. OVERVIEW OF EMF EXPOSURE IN BANGLADESH

In Bangladesh, the power density measurements reported from mobile base stations vary between approximately 17,100 micro-watts and 72,000 micro-watts per square meter in specific urban areas. International guidelines, such as those from the World Health Organization (WHO), establish limits for each frequency band (for instance, GSM900 at 4.7 W/m²) but do not provide thresholds specific to wildlife. Although national surveys conducted by the Bangladesh Telecommunication Regulatory Commission (BTRC) assert that radiation levels at sampled locations are 20-30 times lower than international limits, observers have pointed out that installations are often situated close to schools, hospitals, and residential areas, with insufficient buffer zones. Consequently, this leads to prolonged low-level exposure for humans, animals, and the environment in densely populated regions.

III. EFFECTS ON ANIMALS AND WILDLIFE

In recent years, the swift expansion of mobile phone networks has resulted in the establishment of many mobile phone towers in both urban and rural regions. Although these towers enhance communication, they release radiofrequency (RF) radiation, which has sparked worries regarding its impact on the environment, especially concerning birds and insects.

3.1 Impact of Birds and Insects:

Birds exhibit a high sensitivity to electromagnetic radiation. Numerous studies indicate that RF radiation emitted by mobile towers impacts their navigation capabilities, particularly in migratory birds that depend on the Earth's magnetic field for orientation. The electromagnetic waves disrupt this natural compass, leading to disorientation among birds.

Moreover, prolonged exposure to radiation has been linked to diminished reproductive success in avian species. For instance, research has documented a decrease in egg quantity, thinner eggshells, and lower hatching rates in proximity to mobile towers. Additionally, behavioral alterations such as heightened aggression or abandonment of nesting sites have been noted.

Insects, particularly bees, are even more susceptible due to their diminutive size. RF radiation interferes with their ability to return to their hives, a phenomenon associated with Colony Collapse Disorder (CCD). Bees are vital for pollination, and their decline can significantly affect food production.

Similarly, butterflies and other pollinating insects experience comparable adverse effects. In regions with elevated radiation from mobile towers, reductions in population, disorientation, and decreased reproductive rates have been recorded.

While mobile phone towers are crucial for communication, they present an increasing threat to both birds and insects. These organisms are essential for preserving biodiversity and ecological equilibrium. Consequently, it is imperative to pursue further research and implement safer technological practices, such as improved tower placement and minimizing radiation exposure in sensitive areas like forests, farmlands, and wetlands.

3.2 Livestock & Mammals

The swift growth of mobile communication has resulted in the extensive deployment of mobile phone towers, which continuously emit radiofrequency (RF) radiation. Although this technology is essential for human communication, there is a growing apprehension about its possible harmful effects on animals, especially livestock and mammals. While research is ongoing, numerous studies and field observations indicate that long-term exposure to electromagnetic radiation (EMR) could adversely affect animal health, behavior, and productivity.

Impact on Livestock:

Livestock, including cows, goats, sheep, and poultry, frequently encounter radiation from mobile towers, particularly in rural and semi-urban regions where these towers are positioned close to farms. Exposure to electromagnetic radiation (EMR) has been associated with various physiological and behavioral alterations in livestock.

a. Decreased Milk Production:

Research conducted in countries such as Germany and India has indicated notable declines in milk production among cows residing near mobile towers. This phenomenon may be attributed to hormonal imbalances induced by EMR, which can disrupt metabolic functions and the endocrine system.

b. Reproductive Challenges:

EMR has the potential to disrupt reproductive hormones. In certain instances, farmers have reported a rise in cases of miscarriages, infertility, and diminished conception rates in livestock subjected to elevated radiation levels.

c. Changes in Behavior:

Animals that are exposed to radiation from mobile towers may exhibit signs of agitation, aggression, decreased appetite, and confusion. Such behavioral changes can result in reduced weight gain and overall poor health.

d. Compromised Immune Function:

Extended exposure to radiation may impair the immune system, rendering livestock more susceptible to infections and diseases.

Impact on Mammals (including Pets and Wild Mammals):

Domesticated and wild mammals, such as dogs, cats, rabbits, and even wild species residing near urban areas, are also vulnerable. Given that mammals possess a biological structure similar to that of humans, EMR may affect them in analogous ways.

a. Neurological Effects:

Exposure to EMR has been associated with behaviors related to stress, headaches (as inferred from signs of restlessness), and alterations in brain activity observed in laboratory animals. Certain rodents subjected to RF radiation have exhibited memory impairment and difficulties in learning.

b. DNA Damage: Research conducted on rats and mice suggests that prolonged exposure to RF radiation may lead to cellular stress and potential DNA damage, which could elevate the risk of cancer or other chronic illnesses.

Fig: Impact of microwaves on DNA

c. Effects on Wild Mammals:

Although less extensively documented, mobile towers situated in forests or adjacent to natural habitats may interfere with the migration, reproduction, and habitat utilization of wild mammals due to electromagnetic radiation (EMR) and the associated lights and noise from the towers.

The impact of mobile phone towers on livestock and wild mammals is an increasing concern, especially as the number of towers rises in proximity to residential and agricultural areas. While further large-scale research is necessary to draw definitive conclusions, current studies indicate the need for precautionary actions. These actions may involve regulating the placement of towers, enhancing awareness among farmers, and performing regular health evaluations of animals located near mobile towers to safeguard their welfare and maintain the overall ecological balance.

3.3 Flora and Soil Ecosystems

The soil ecosystem is an intricate and fragile network consisting of microorganisms, fungi, insects, organic matter, and minerals. These elements are crucial for nutrient cycling, plant development, and the overall health of the ecosystem. The radiation emitted by mobile towers may subtly yet significantly affect this equilibrium.

a. Decrease in Microbial Activity:

Soil microbes are vital for the decomposition of organic matter and nitrogen fixation. Research indicates that exposure to electromagnetic radiation (EMR) can diminish microbial biomass, enzyme activity, and soil respiration rates, resulting in reduced fertility.

b. Disturbance of Earthworms and Insects:

Organisms such as earthworms, ants, and other soil-dwelling species are particularly sensitive to electromagnetic fields. Extended exposure may cause

migration, reproductive issues, or mortality, thereby disrupting soil structure and nutrient cycling.

c. Changed Soil Composition:

Prolonged exposure to radiation may alter the chemical equilibrium within the soil, impacting pH levels and the accessibility of vital nutrients such as potassium and phosphorus. While mobile phone towers are crucial for contemporary communication, their ecological repercussions—particularly on plants and soil—deserve significant consideration. Disruptions to plant development and soil vitality can lead to far-reaching consequences for agriculture, biodiversity, and food security. Consequently, it is imperative for policymakers and environmental organizations to evaluate the environmental hazards associated with tower placement, encourage additional research, and contemplate buffer zones between towers and vulnerable ecosystems to promote sustainable development and environmental conservation.

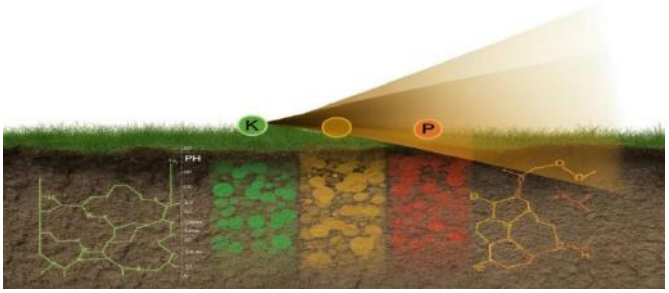

Fig: Long-term radiation effect on soil

IV. EFFECTS ON HUMAN HEALTH

Mobile phone towers, commonly referred to as cell towers or base stations, have become a vital component of contemporary communication infrastructure. Nevertheless, there are increasing global concerns regarding the possible health risks linked to prolonged exposure to the radiofrequency (RF) electromagnetic radiation emitted by these towers. While mobile towers offer robust network coverage, their presence in densely populated regions has prompted researchers and health professionals to investigate their effects on human health.

a. Sleep Disturbances

One of the most frequently reported problems by individuals living near mobile towers is diminished sleep quality. Research has associated prolonged exposure to RF radiation with changes in melatonin production, a hormone responsible for regulating sleep. This can result in insomnia, fatigue, and daytime drowsiness.

b. Headaches and Cognitive Issues

Individuals residing within 100–300 meters of towers often report persistent headaches, challenges in concentration, memory difficulties, and irritability. Although establishing causality is challenging, these symptoms are commonly noted in epidemiological research.

c. Increased Stress and Anxiety

Ongoing low-level radiation exposure may contribute to psychological stress, anxiety, and even depression. Alterations in brain activity, hormonal imbalances, and disturbances in the nervous system could be contributing factors.

d. Cardiovascular Symptoms

Some research indicates that RF radiation may influence heart rate variability, potentially leading to palpitations or irregular heartbeats, particularly in individuals with pre-existing heart conditions.

e. Cancer Risk

This continues to be the most contentious field. In 2011, the International Agency for Research on Cancer (IARC) of the World Health Organization classified RF radiation as "possibly carcinogenic to humans (Group 2B)" due to evidence connecting prolonged mobile phone usage with glioma, a form of brain cancer. While this classification did not specifically address towers, apprehensions persist regarding long-term exposure to towers, particularly among children and pregnant women.

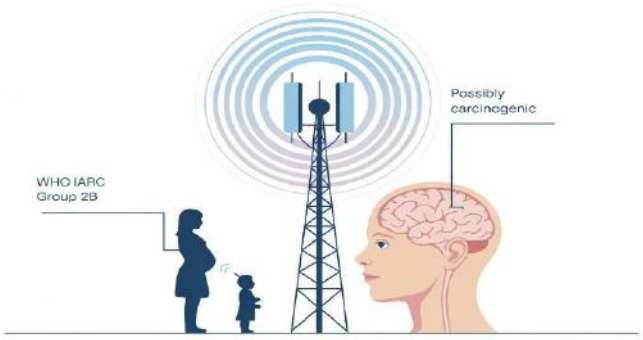

Fig: Impact of microwaves on brain cancer

f. Reproductive Health

Recent studies indicate possible impacts on male fertility, highlighting reports of reduced sperm quality and motility in individuals subjected to elevated levels of RF radiation. Although mobile phone towers are essential for communication, increasing evidence implies that prolonged exposure to their radiation could influence human health, particularly among vulnerable groups. As research advances, it is crucial to adopt precautionary measures, enhance public awareness, and enforce stricter regulations to reconcile technological advancement with the safety of public health.

V. EVOLUTION OF SAFETY STANDARDS

The following is a brief summary of the wireless safety standards, which have become stricter over time.

• 1966: The ANSI C95.1 standard adopted the standard of 10 mW/cm2 (10,000 µW/cm2) based on thermal effects.

• 1982: The IEEE recommended further lowering this limit to 1 mW/cm2 (1,000 W/cm2 or 10 µW/m2) for certain frequencies in 1982, which became a standard ten years later in 1992.

• 1986: The national council on radiation protection and measurements (NCRP) recommended the exposure limit of 580 µW/cm2.

• 1992: The ANS/IEEE C95.1-1992 standard based on thermal effects used the 1 mW/cm2 (1,000 µW/cm2) safety limit. The United States Environmental Protection Agency called this revised standard "seriously flawed", partly for failing to consider non-thermal effects, and called for the FCC to adopt the 1986 NCRP standard, which was five times stricter.

• 1996: The FCC updated to the standard of 580 µW/cm2 over any 30 minute period for the 869 MHz, while still using 1 mW/cm2 (1,000 µW/cm2) for PCS frequencies (1850-1990 MHz).

• 1998: The ICNIRP standard uses the limit of 450 µW/cm2 at 900 MHz, and 950 µW/cm2 at 1900 MHz. The limit is frequency dependent.

VI. EXPOSURE ASSESSMENT & REGULATORY STANDARDS

The global impact of mobile phone towers on human health remains a subject of debate, with numerous regulatory agencies asserting that there is no definitive evidence of harm at present exposure levels. However, in Bangladesh, there have been several anecdotal accounts and small-scale studies reporting symptoms such as headaches, sleep disturbances, memory loss, chest tightness, and skin irritations among individuals residing within a few hundred meters of these towers. Proposed biological mechanisms include oxidative stress, disruption of endocrine functions, DNA damage, and neurological effects. Although this emerging evidence is not conclusive, it raises concerns regarding the cumulative and long-term effects of low-dose exposures, particularly in the context of developing countries.

Bangladesh adheres to international guidelines established by organizations such as the International Commission on Non-Ionizing Radiation Protection (ICNIRP), although the enforcement of these guidelines may differ. Experts highlight the importance of ensuring safe tower placement, limiting installations near schools, hospitals, and residential neighborhoods, as well as conducting regular monitoring of radiation levels.

VII. DISCUSSION

In recent years, the swift growth of mobile phone networks in Bangladesh has resulted in the extensive installation of mobile phone towers throughout urban, semi-urban, and even rural regions. While these towers facilitate uninterrupted communication and digital connectivity, there is a rising concern regarding their possible negative impacts on human health and the environment, particularly concerning animals and ecological systems. This issue is particularly urgent in Bangladesh due to its high population density, unregulated urban development, and a lack of awareness regarding radiation risks.

The electromagnetic radiation (EMR) produced by these towers, particularly in the form of radiofrequency (RF) waves, is non-ionizing yet persistent. Although it is deemed low-level, prolonged exposure raises considerable health concerns. In Bangladesh, numerous towers are situated in close proximity to residential

neighborhoods, schools, hospitals, and even on the rooftops of residences without clear safety protocols. This closeness to everyday human activities heightens the risk of health-related issues.

One of the most significant challenges in Bangladesh is the absence of awareness and regulation. The installation of towers frequently occurs without adequate consultation with local authorities or environmental evaluations. Existing policies are ambiguous, and enforcement is lax. Consequently, towers are occasionally positioned in inappropriate locations, unnecessarily increasing public exposure.

To alleviate these risks, Bangladesh must implement a more balanced strategy. Stricter regulations should be enforced to govern tower placement, particularly distancing them from sensitive areas such as schools, hospitals, and wildlife habitats. Additionally, awareness campaigns are essential to inform the public and telecom companies about safe distances and exposure limits.

VIII. RECOMMENDATIONS

1. Implement compulsory Environmental Impact Assessments (EIA) for the installation of new mobile towers, which include assessments of risks to flora and fauna.

2. Establish minimum buffer zones (for instance, greater than 50 meters) from educational institutions, healthcare facilities, residential areas, and conservation regions.

3. Install continuous monitoring stations to measure RF-EMF exposure—including in wildlife and plant areas—and ensure that the data is reported publicly.

4. Encourage environmentally friendly tower placement practices: avoiding rooftops, ensuring antenna heights exceed 30 meters, and utilizing shared infrastructure to minimize the number of towers.

5. Provide funding for longitudinal cohort studies in Bangladesh focusing on human exposure, as well as ecological field studies that assess population trends in birds, insects, and trees in proximity to towers.

6. Create public awareness campaigns that highlight the importance of informed consent and the right to live in healthy environments.

IX. CONCLUSION

Mobile phone towers play a crucial role in ensuring modern connectivity in Bangladesh. However, the increasing ecological concerns and initial human health indicators linked to their radiation emissions indicate that we must not overlook the environmental and biological impacts. Particularly in densely populated urban areas and biodiverse rural regions, taking precautions necessitates more than just adherence to human-focused thermal limits. Comprehensive national research, regulatory changes, and the integration of ecosystem protection should be integral components of Bangladesh's telecommunications expansion strategy. In summary, although mobile towers are crucial for digital connectivity and advancement, the potential health and environmental risks they present must not be overlooked. A precautionary strategy, supported by scientific studies and robust regulations, is necessary to safeguard both humans and wildlife in Bangladesh.

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